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NEW SOVIET DOUBLE-ROW RADIAL ROLLER BEARINGS

B. G. Popovich

Very good results have been obtained by the use of double-row cylindrical roller bearings with adjustable radial play for supporting spindles on modern high-speed and heavily loaded tools.

The new-type double-row radial roller bearings, Series 3182100, have short cylindrical rollers and a tapered hole When used on high-speed screw-cutting lathes, these bearings are made according to GOST 520-45, Grade H accuracy. The rollers are accurately aligned by means of three ribs on the inner race. A cage retains both rows of roller in alternating positions on the inner race.

The outer race can be installed in the spindle separately from the inner race and set of rollers. In this case, the outer race is not interchangeable. To facilitate installation, the race of the outer ring is tapered 3 millimeters from each end.

The one-piece machined cage is made of LS59-1 brass and is centered on the rollers.

The allowance for concentricity of the races in respect to the hole is very small. Both races are ground in one operation. Their diameters have a tolerance of 2-3 microns. Deviation from the perpendicularity of the ribs to the race and the end surfaces of the rollers to the genetrix does not exceed 5 microns. The allowance for taper of the hole is in the range of + (2 ÷ 3) microns throughout the width of the ring.

The short length of the rollers in comparison with their diameter ensures their accurate alignment (napravleniye).

The basic production of the bearings described calls for Grade B and A accuracy (GOST 520-45).

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Because of the increased number of rollers in each row, the alternating order of their positions, and the long line of contact between the rollers and races, the bearings have high rigidity and a large load capacity. Radial deflection and deformation within the bearing under load is considerably less in bearings of other types. For example, the deflection under one load for Series 36200 (46200) bearings will be six to seven times greater than that for Series 3182100 roller bearings with the same hole diameter. Even with preliminary tightening, the radial deflection of the specified bearings under load will still be four to five times greater than in Series 3182100 bearings.

Since the outer race of the new-type roller bearings can be fitted into the shank with a high degree of tightness, no allowance need be made for deflection of this race. This represents an improvement over radial and radial-thrust ball bearings, and particularly over floating bearings, for which tight fits are not recommended and clearance between shank and outer race is frequently necessary.

Double-row roller bearings are not intended for receiving axial loads. For this reason, thrust and radial-thrust bearings must be used in the spindle-support unit.

The use of double-row roller bearings in combination with thrust ball bearings achieves an extremely high radial, and especially axial, spindle accuracy.

The accuracy of spindle rotation in the radial direction is achieved by precision-built inner races and set of rollers.

However, in connection with the axial accuracy, it is necessary to take into consideration that the axial play of thrust bearing races is considerably smaller than the side play on radial thrust bearing races having the same dimensions and the same grade of accuracy. (see the table below).

Internal Diam of Radial-Thrust Ball Bearings, Series B6200 (or 46200) (mm)		Side Play on Inner Races According to GOST 520-45 (microns)		Internal Diam of Thrust Ball Bearings, Type 8000 (mm)		Side (axial) Play on Single Thrust Ball Bearing Races According to GOST 520-45 (microns)	
From	To	Grade of Accuracy		From	To	Grade of Accuracy	
		A	B			A	B
--	30	13	20	--	30	5	10
30	50	13	20	30	50	6	10
50	80	18	25	50	80	7	10
80	120	18	25	80	120	8	15
120	180	20	30	120	180	10	15

A very important characteristic of roller bearings with tapered holes is the adjustability of radial clearance. It should be mentioned that these roller bearings are manufactured with smaller radial clearances than any other radial roller bearing.

For adjusting the degree of radial clearance during installation or periodic adjustment to prevent wear, it is sufficient to move the inner race of the bearing along the tapered part of the shaft a suitable distance.

The cylindricality of the race of the outer ring can be checked after it is installed in the shank.

Bearings of this type are difficult to install and must be put in by an experienced mechanic.

Because of the cylindrical shape of the rollers, there is no sliding friction in the bearing except where the rollers touch the walls of the cage and the ribs on the inner race. For this reason, the temperature of these bearings under various speeds and loads remains low and varies only slightly.

Having a high load capacity, these bearings have a comparatively small external diameter. Although this is a definite advantage in supporting machine-tool spindles where the space for outer bearing races is limited, it is desirable that the spindle diameter be larger, in particular, if the spindle must be hollow for holding bar stock, etc.

In cases where the work piece determines the diameter of the spindle hole because of the small depth (vysota) of the bearing cross section, it is possible to make the external diameter of the spindle shank smaller. This is particularly important for multispindle automatics.

These bearings are suitable for the front spindle support of 1A62 high-speed screw-cutting lathe, but for the rear support of the spindle, type 8215 thrust ball bearings and Type 7514 tapered roller bearings are used.

The new bearings can also be used for supporting spindles in automatic turret lathes and high-speed, high-production universal milling machines.

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